COVER SHEET

INHIBITORS OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT IN THE AUSTRALIAN CONSTRUCTION INDUSTRY

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ABSTRACT

The introduction of Ecologically Sustainable Development (ESD) is considered to be critical for the construction industry and yet progress has been slow to date. Despite an extensive literature on the topic, little empirical research has been conducted to determine why this has been the case.

This paper reports on a 2004 questionnaire survey of a cross-section of construction stakeholders in Australia to gain an understanding of the factors that contribute to the lack of ESD in the construction industry. Of the 134 questionnaires despatched, 53 were returned completed from variety of locations including Brisbane, Sydney, Melbourne, Adelaide and Perth. A further 16 were completed by means of telephone interviews, mostly in Queensland.

The results indicate the existence of a range of significant inhibitors, comprising: stakeholders' or decision-makers' lack of knowledge in terms of lack of awareness, understanding, appreciation and expertise; lack of capacity within the construction industry, in terms of lack of interest, initiative, research and development, and cooperation and consensus; and inadequacy of governing policy, in terms of lack of implementation, appropriate and well defined policy and failure of policy makers and politicians.

KEYWORDS:

Ecologically Sustainable Development, sustainable construction, survey, barriers, Australia.

INTRODUCTION

The concept of sustainable development gained momentum in Australia in the 1980s with the emergence of an increasing amount of scientific evidence concerning the depletion of the environment (Langston and Ding 1997:21). The financial loss alone from land and water degradation has been estimated at AUD1.4 billion per year (Productivity Commission 1999:3). As a result, the State of the Environment Advisory Council identified a number of areas where the natural environment is under pressure, such as land and water degradation; habitat loss; and decline in air quality (Productivity Commission 1999:3).

The issue is also a critical one for the construction industry (e.g., Langston and Ding 1997; CIB 1999; CSIR Building 2002) and the notion of sustainable construction has been offered as a potential solution. As a part of Ecologically Sustainable Development (ESD)[1], sustainable construction is "a holistic process aiming to restore and maintain harmony between the natural and built environments, and create settlements that affirm human dignity and encourage economic equity" (CSIR Building 2002:8).

Progress seems to have been slow to date, however, with CIB (1999:49) reporting a general lack of sustainable construction and ESD, many reasons have been suggested. For example, a lack of awareness due to inaccurate data and expertise (Governments at the United Nations Conference on Environment and Development 1992:267), clients finding it difficult to change their view of sustainable development due to lack of knowledge (Bordass 2000:350), lack of capacity of the construction sector (CSIR Building 2002:35), inappropriate project organisation and stakeholders (Rwelamila *et al* 1999:39), inadequate policy performance (Dovers 2002:563) and inappropriate building codes (Kibert 2003:84).

Limited research in Australia has been reported by Margerum (2001); Fung *et al* (2001); Willis (2001); Research Paper for Business Council of Australia (2003); Dovers (2002); Langston and Ding (1997); Barton *et al* (2001); Walker (2002) and Bajracharya (2001). Most of these research papers are theoretically based however. In this paper we report on a survey conducted in 2004 aimed at determining the main issues inhibiting sustainable construction activity in Australia. The results indicate the existence of a range of significant inhibitors, comprising: lack of knowledge in stakeholders or decision-makers in terms of (in order of impact) lack of awareness, understanding, appreciation and expertise; lack of capacity within the construction industry, in terms of (in order of impact) lack of interest, initiative, research and development, and cooperation and consensus; and inadequacy of governing policy, in terms of (in order of impact) lack of implementation, appropriate and well defined policy and failure in policy makers and politicians.

[1] Defined as *"…development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (WCED:8).

LITERATURE REVIEW

Unsurprisingly for such an important and topical issue, the literature base is very large. For convenience, these are categorised into three main factors and their sub factors comprising:

Lack of stakeholders' or decision-makers' knowledge

Lack of awareness
Lack of understanding
Lack of expertise and appreciation

Lack of capacity within the construction industry

Lack of initiative and interest
Lack of research and development
Lack of cooperation and consensus

Inadequacy of governing policy

Lack of implementation
Lack of appropriate policy
Failure of policy makers and politicians

Some comments on these insofar as this research is concerned are summarised below.

Lack of knowledge in stakeholders or decision-makers

Lack of awareness

As recently as September 2003, Rovers (2003:17) stressed that it is time to recognise and become aware of sustainability issues, pointing out that "there are a lot of challenges to focussing on environment aspects". He also urged government, politicians and economists to take responsibility in addition to designers. Similarly, the Governments at the United Nations Conference on Environment and Development (1992:267) revealed "a considerable lack of awareness due to inaccurate data and expertise", this ultimately becoming the basis for action as "an essential part of a global education effort" towards sustainable development. Likewise, Thomas (1992:151) recommended that environment awareness "needs experience of dealing with a wide range of environment issues". He also noted an acute lack of relevant empirical evidence.

In the French context, Bourdeau (1999:363) opined that "understanding is not mature" for the participants in the construction industry, public, politicians and government administration. Within the USA context, Bakens (2003:10) has pointed to a general failure of awareness-raising campaigns to sufficiently influence stakeholders, although his assumption that "properly motivated, educated and facilitated professionals are available in all situations to carry out proper planning, design, construction, management, maintenance and deconstruction" may be somewhat misplaced as such professionals are not always available for construction work. That there is often no consensus-based professional opinion may also negate the effects of raised awareness.

In Australia, it has also been suggested that the key to sustainable practice is an increase in awareness, based on the view that sustainable building practice will eventually become an industry standard (Barton *et al* 2001) and this has led to the idea that it will be more beneficial to raise awareness among a broader consensus community rather than among the professionals themselves (Margerum (2001).

Lack of understanding

It has been suggested that the lack of understanding of ESD is due to the lack of a common conceptual framework and key terminology (Bakens 2003). On the other hand, Curwell and Cooper (1998) claim a lack of clarity or knowledge to be responsible although theirs is based more on the viewpoint of urban sustainability.

In the South African context, Rwelamila *et al* (1999) believe the understanding that is needed concerns social, economic, biophysical and technical principles. In Australia, however, although it is agreed that the ESD principles should be applied (Barton *et al* 2001), the principles themselves are dissimilar and said to mainly focus on "economic, social and environment" issues (Productivity Commission 1999:2). Also within the Australian context, it is believed that the arguments about sustainability "may not relate to the theories and concepts, but relate to example" (Margerum 2001:347). Finally, it is noted that, with the exception of Sunikka and Boon (2003), the remaining literature is based on theories and concepts (e.g., Plessis 1999) rather than any empirical evidence.

Lack of expertise and appreciation

Most of the literature concerning this aspect is theoretically based. It has been assumed, for example, that planners in general are inexperienced and focus more on economic interests than environmental interests (Thomas 1992). In the UK context, it has been suggested that all that is needed is to educate future designers and managers to fully appreciate sustainability issues (Courtney 1999). In the USA, on the other hand, it is believed that integrated thinking is needed (Bakens 2003). It has also been suggested that the "barriers and challenges in developing countries are substantially different because of social, economic and institutional characteristics" (Bakens 2003:11) and the lack of appreciation and expertise in developing countries is not applicable in Australia (CSIR Building 2002). However, the Rio Declaration on Environment and Development (Governments at the United Nations Conference on Environment and Development 1992) suggests that there is still considerable lack of expertise even within developed nations.

Lack of capacity within the construction industry

Lack of initiative and interest

Despite "a fairly strong indication of activity and interest" in sustainable construction in the USA market (*White Paper Survey* cited in Building Design and Construction 2003:38), construction industry Research & Development (R&D) spending is only 0.2-0.5% of the annual sales (Building Design and Construction 2003). Politicians and the general public have also been found to have little interest in building and construction issues and even the three stakeholder groups (actual decision makers, building and construction professionals, and researchers) seldom show sufficient initiative and interest to cooperate in finding solutions (Bakens 2003). Lack of interest has also been a long-standing issue in the UK, where construction sustainability is often seen as a "new agenda for planning" (Thomas 1992:149). A similar lack of interest is said to prevail in developing countries and where there are "very different climatic, cultural and economic conditions" (CSIR Building 2002:3).

Once again, however, most of the literature concerning this issue is theoretically based. Bakens (2003) results, for example, are only based on a case study of international debates, while Eclipse Research Consultant (in Curwell and Cooper 1998, 20) only studied those who shared an agenda on sustainability at the level of the lowest common denominator. It has also been commented that the UK and USA situation may not apply in the New Zealand context, for example, as no in-depth national studies have yet been conducted (Jaques 2001). A similar situation applies in Australia, where sustainability issues are relatively new (Dovers 2002:564).

Lack of research and development

It has been said that the "limited information and data" on sustainable materials in the UK is due to the lack of research being carried out in the construction industry (Chen and Chambers 1999:690). As mentioned above, the USA construction industry generally has a very low rate of expenditure on R&D, with a lack of unified R&D effort and current R&D programmes that are scattered among numerous agencies (Bakens 2003). This is also a world-wide phenomenon. Construction R&D in developing countries, for example, is done in a holistic manner and coordination between agencies is lacking (CSIR Building 2002). It is, however, not clear to what extent this may apply in the Australian context and its influence on the introduction of sustainable construction as no literature exists for that region as yet.

Lack of cooperation and consensus

The USA building and construction sector is said to have "more potential to achieve sustainability" and that is why it requires "close corporation among stakeholders" (Bakens 2003:9). These challenges are also considered to be important for those in other developed regions (Courtney 1999). Within the Australian context, most of the literature is rather conjectural. Barton *et al* (2001), for example, assume that architecture and engineering depend upon cooperation to be well positioned for ESD. Margerum's (2001) work, on the other hand, is based on the evaluation of local government plans in South East Queensland. Sharma and Vredenburg's (1998) empirical work, however, has showed that traditional organisations tend to be focussed on a limited set of stakeholders. It also seems that lack of cooperation is inter-related with other factors reviewed earlier, such as a lack of understanding.

Inadequacy of governing policy

Lack of implementation

Most of the literature concerning this aspect is empirical and most agree that lack of implementation is inter-related with other factors such as the failure of policy makers and politicians. Rovers (2003) and Dovers (2002), for example, stress the idea of "policy processes" or "policy development", with both focussing not only on the lack of implementation, but also on policy identification as well as policy monitoring. Similarly, Whitney (1992) comments that the implementation of policies will be politically unattractive, linking the two factors: lack of implementation and failure in policy makers and politicians. Bon and Hutchinson (2000) and Langston and Ding (1997), on the other hand, consider implementation problems to apply more to developing nations.

From an Australian perspective, Dovers (2002) research is relevant. Bajracharya's (2001) work on barriers to sustainability, however, is more concerned with housing development policy than overall sustainability policy and may not be especially relevant to the Australian scene. Similarly, Sha *et al*'s (2000) research is in the China context and may not be applicable to the Australian position due (but not limited) to the dissimilar legal systems, political conditions and cultural factors. Likewise, Sunikka and Boon (2003) research is based in the Netherlands.

Lack of appropriate policy

It has been said that even if all were fully implemented, national policies will still fail to bring true sustainability development (Rovers 2003) thereby demonstrating the need for improved policies. The literature concerning this aspect is a mixture of theory and

empirically based data. Willis's (2001) work in the Sydney region, for example, is an empirically based case study on the Sydney Olympics and it seems reasonable, therefore, to apply it in the Australian context. Similarly, Dovers' (2002) research

reviews Australia's progress in sustainability, especially in policy, while the Research Paper for Business Council of Australia (2003) is mainly theoretically based. In contrast, the Strand and Fossdal (2003) research is mainly based on a developing region context and may not be applicable to the local context. Similarly, as mentioned previously, the Sha *et al* (2000) research may also not be applicable to the Australian context.

Failure in policy makers and politicians

Failure in policy makers and politicians seems to be inter-related with other factors such as lack of implementation, with Whitney (1992), for example, noting that the implementation of policies may not be politically attractive. Similarly, Raynsford (1999) assumes that UK policy makers should incorporate economic, environment and social objectives into the policy for long-term effects. Raynsford (1999), however, did not take into consideration the short-term effects facing the UK at that time.

Both Walker (2002) and Fisher (2001) relate their research to the local context of Queensland, although it is likely that their results will apply nation-wide for, as Whitney (1992) comments highlights, the difficulties in federal structure are very similar to the local context, where each state in Australia is under the power of Federal Government. Margerum's (2001) work is Australia-based too, although she assumed in her findings that the constraints were resource issues especially for small rural councils, and therefore not necessarily applicable in metropolitan areas. Also, from the Research Paper for Business Council of Australia (2003), it is not clear to what extent the author defines the "light handed approach" of the government.

Finally, it should be mentioned that the Productivity Commission (1999) claimed that the failure in policy is mainly due to the inadequate definition of ESD. This sub-problem again may be inter-linked with "the lack of knowledge in stakeholders", creating a continuous escalation of the main problems.

METHOD

A quantitative study, comprising a postal questionnaire survey was developed to gather information on the three factors and their sub-factors identified in the literature and administered to a cross-section of Australian construction stakeholders, mainly

Architects, Project Managers, Engineers, Quantity Surveyors, and Government Employees. A qualitative study, comprising telephone interviews to various organisations such as Architects, Project Managers, Engineers, Quantity Surveyors, and Government, was also conducted to gain an understanding of the nature of these and other factors that contribute to the lack of ESD in the construction industry.

RESULTS

Respondents

Survey questionnaires were mailed to 134 potential respondents in all five main cities in Australia. 53 completed questionnaires were returned comprising 18 from Brisbane, 10 from Sydney, 11 from Melbourne, 5 from Adelaide and 9 from Perth. A further 16 questionnaires were completed by means of telephone interviews, mostly in Queensland

The questionnaires were completed by a cross-section of building professionals, comprising architects (10), project and construction managers (18), quantity surveyors and estimators (12), engineers (7), government employees (11) and other professionals such as clients, contractors and labourers (11). 77% of the respondents are aged less than 40 years old. On the other hand, 63 (91%) have at least a university degree with seven holding a postgraduate certificate. Almost all respondents have some awareness of the existence of ESD in Australia, 31% having a low awareness, 50% a medium awareness and 19% a high awareness.

The mean responses for each question by each respondent type (1=strongly disagree: 5=strongly agree) are given in the sections below.

Research factor 1: Lack of stakeholders' or decision-makers' knowledge

Most respondents agree that lack of knowledge does have or will contribute to the lack of ESD in Australia construction industry. With an overall sample mean of 3.65 and 0.061 standard error, there is significant agreement that lack of awareness, understanding, appreciation and expertise are important factors contributing to the lack of knowledge among stakeholders or decision-makers. A one-way ANOVA and Levine's test indicates the occupational responses to be indistinguishable in terms of means ($F_{5,270}$=1.27, p=0.28) and variances ($F_{5,270}$=1.39, p=0.23). The nonparametric Kruskal-Wallis one-way ANOVA provides the same result ($H_{5,276}$=7.14, p=0.21). The mean *rankings* provided for the factors, however, differ significantly between factors ($H_{3,276}$=37.39, p=0.0000), with the lowest (most important) being "lack of awareness" (1.97), followed by "lack of understanding" (2.23), "lack of appreciation" (2.83) and "lack of expertise" (2.97).

Respondents also believe that stakeholders or decision-makers play an important role in determining the success of ESD in the Australian construction industry (3.83 mean score) and have a responsibility to ESD (3.67 mean score), with 37% agreeing that clients are the most important stakeholders, followed by 29%, 16% and 13% for architects, government and developers respectively.

Other comments were that:

- There is a general lack of appreciation of what has to be done to save scarce resources
- Better informed clients are needed to drive builders to change and accept ESD
- Many people are generally not aware of ESD, and even if they are, they tend to bypass it.

Research factor 2: Lack of capacity within the construction industry

Most respondents agree that lack of capacity does have, or will contribute to, the lack of ESD in Australia construction industry. With an overall sample mean of 3.66 and 0.072 standard error, there is significant agreement that lack of initiative, interest and cooperation and consensus have a major impact on the lack of capacity within the construction industry. One-way ANOVA and Levine's test indicates the occupational responses to be indistinguishable in terms of means ($F_{5,270}$=0.99, p=0.42) and variances ($F_{5,270}$=1.50, p=0.19). The Kruskal-Wallis one-way ANOVA provides the same result

($H_{5,276}$=4.95, p=0.42). Again, the mean *rankings* provided for the factors are significantly different between factors ($H_{3,276}$=16.60, p=0.009), with the lowest (most important) being "lack of interest" (2.17), followed by "lack of initiative" (2.32), "lack of research and development" (2.62) and "lack of cooperation and consensus" (2.88).
Respondents also believe that the construction industry plays an important role in determining the success of ESD in the Australian construction industry (3.84 mean score) and should work in more collaborative manner (3.93 mean score), with 70% and 74% agreeing/strongly agreeing that construction industry plays an important role and should work in a more collaborative matter respectively.
Other comments were that:

- Most stakeholders would not proceed with ESD due to lack of current implementation
- People have to make an initial effort and show support for the implementation of ESD
- Current procurement methods generally do not allow for post-design ESD
- The whole construction industry looks for profit and cost effectiveness rather than ESD
- End-users or clients always consider the up-front capital costs rather than life cycle costs.

Research factor 3: Inadequacy of governing policy
As with the previous two factors, most respondents agree that inadequacy of governing policy does have or will contribute to the lack of ESD in Australia construction industry. With an overall sample mean of 3.81 and 0.071 standard error, there is agreement that these have a significant impact. One-way ANOVA and Levine's test again indicate the occupational responses to be indistinguishable in terms of means ($F_{5,201}$=0.41, p=0.84) and variances ($F_{5,201}$=0.26, p=0.93), with the Kruskal-Wallis one-way ANOVA providing the same result ($H_{5,207}$=2.86, p=0.72). Likewise, the mean *rankings* provided for the factors are again significantly different between factors ($H_{2,207}$=7.05, p=0.0294), with the lowest (most important) being "lack of implementation" (1.80), followed by "lack of appropriate and well defined policy" (2.04) and "failure in policy makers and politicians" (2.62).
Respondents also believe that governing policy plays an important role in determining the success of ESD in the Australian construction industry (3.99 mean score) and the current or existing policy is ineffective (3.77 mean score).
Other comments were that:

- Most stakeholders would not implement ESD because there is no benchmark or well-defined standard
- Existing policy is not set out properly and this will lead to minimal control and no implementation
- Existing town planning is only fractionally made up for ESD.

• Inadequacy of governing policy is tied directly to commercial viability and also political will
• The less the interest and initiative, the less the chances of ESD being implemented
• Without proper policy in place, developed construction projects will never compliment one another
• There is no control on ESD on sites or building.
• There is a lack of structure and a proper framework within governing bodies or local councils
• The reason of lack of capacity is because of no resources to begin with
• A better informed policy is necessary to drive other stakeholder to change.

Other factors: not reviewed in literature

Most respondents agree that the other factors of "Lack of available funds or investments", "Lack of accurate data and information", "Uncertain economic environment", "Lack of "green" or reuse and recycle materials", "Lack of publications and promotion" and "High cost on "green" or reuse and recycle materials" does have or will contribute to the lack of ESD in Australia construction industry. With an overall sample mean of 3.45 and 0.062 standard error, there is agreement that these have a significant impact. This time, one-way ANOVA and Levine's test indicates this to be indistinguishable between factors in terms of means ($F_{5,408}$=0.97, p=0.44) but not variances ($F_{5,408}$=4.05, p=0.0013). The Kruskal-Wallis one-way ANOVA provides the same result ($H_{5,414}$=4.22, p=0.52).

Overall view of 3 key independent variables

As Fig 1 shows, the respondents ranking of the three factors are very similar.

In response to further questioning, a majority of 72% respondents thought that sustainable construction or ESD would become 'mainstream' in the Australian construction industry in the future. Of these 72%, the reasons given were due to:

- Resources becoming scarce, limited and higher cost;
- End-users or buyers looking for ESD;
- The benefits of cost effectiveness of ESD;
- Needing to make sure future generations will be able to have sufficient resources;
- The future being concerned with maintaining is suitable balance between environment and development;
- ESD becoming essential; and
- ESD becoming industry practice and government policy.

Of the remaining 28% of respondents, their reasons for not foreseeing sustainable construction are because of:

- A very strong economy-cost factor
- Lack of education on ESD
- Clients and end-users unwilling to spend more money.

CONCLUSIONS

The results of the survey are quite clear – that several significant problems exist that are restricting the rate of adoption of ESD in the Australian construction industry. It is an obvious outcome that, at this stage, ESD in the construction industry in Australia remains largely not successfully implemented although first introduced more than a decade ago. Of the three main inhibitors examined - stakeholders' or decision-makers' lack of knowledge, lack of capacity within the construction industry and inadequacy of governing policy – all are found to be equally responsible although there are some ranking differences within each.

Whether the presence of these inhibitors is necessary/desirable or not remains to be seen. As with many initiatives emanating from the ecological movement, there is a marked reluctance to move to some form of voluntary implementation in the absence of

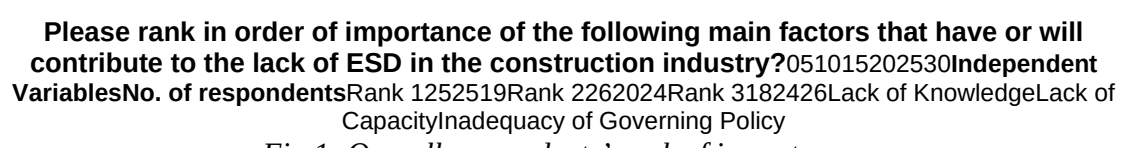

Fig 1: Overall respondents' rank of importance.

government intervention. For many, this is taken to be a clear sign of market failure and in urgent need of rectification. For others, significantly at the top government level, there seem to be too many uncertainties involved at present to allow decisive action to be taken. It is suspected, however, that the necessary changes will take place only when suitable government regulation is forthcoming as the market itself seems to be a notably inadequate mechanism for this to happen in a natural way.

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